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Recommended Best Management Practices for the Southern Hog-nosed Snake (*Heterodon simus*) on Department of War Installations

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Abstract

The Department of War (DoW), through its Partners in Amphibian and Reptile Conservation (PARC) network and the U.S. Fish and Wildlife Service (USFWS) have cooperatively developed Best Management Practices (BMPs) for the Southern Hog-nosed Snake (*Heterodon simus*). This at-risk snake has confirmed occurrences on 12 military sites and is currently under consideration for listing as Threatened under the Endangered Species Act (ESA) by the USFWS. These recommended BMP's offer military resource managers practical tools to plan, prioritize, and implement effective conservation strategies for the Southern Hog-nosed Snake. By integrating these BMPs into Integrated Natural Resource Management Plans (INRMPs), installations can maintain military readiness while supporting broader conservation objectives. This collaborative effort between DoW and the USFWS complements ongoing initiatives by the DoW, federal and state agencies, and conservation partners to prevent further population declines of at-risk species while sustaining military mission readiness. DoW PARC is thankful to the DoW Legacy Resource Management Program for providing funding to conduct this evaluation and reviewing and editing this report.

Introduction

The Southern Hog-nosed Snake (*Heterodon simus*) is an at-risk species that the U.S. Fish and Wildlife Service (USFWS) has proposed to list as Threatened under the Endangered Species Act (ESA) with a 4(d) rule (see Conservation Status section below for details). In support of mission readiness and proactive conservation, the Department of War (DoW), through its Partners in Amphibian and Reptile Conservation (PARC) network, collaborated with the USFWS and experts on this species to develop these Best Management Practices (BMPs). While designed specifically for DoW installations, the practices outlined here are applicable across the species' range.

These guidelines offer military resource managers practical tools to plan, prioritize, and implement effective conservation strategies for the Southern Hog-nosed Snake. They also help ensure compliance with regulatory frameworks such as the National Environmental Policy Act and the Sikes Act. By integrating these BMPs into Integrated Natural Resource Management Plans (INRMPs), installations can maintain military readiness while supporting broader conservation objectives. This collaborative effort complements ongoing initiatives by the DoW, federal and state agencies, and conservation partners to prevent further population declines and thus potentially prevent the federal listing of this species.

Species Profile

Description

Adult Southern Hog-nosed Snakes typically measure between 33.0 and 56.0 cm in total length. Females generally grow larger than males (Palmer and Braswell, 1995), although males have slightly longer tails despite their overall smaller size. The species is characterized by a sharply upturned rostral scale at the tip of the snout and stout body.

The body coloration is light brown, gray, gray-brown, or tan, marked by alternating dark brown blotches along the dorsum—larger spots along the midline and smaller ones on the flanks (Figures 1-3). The venter is whitish in color and usually lightly mottled or stippled with black, gray, or brown (Figure 4). The underside of the tail is a similar color to the rest of the venter, which distinguishes this species from other hog-nosed snakes, as does an orange, yellow, or red line that often continues down the dorsal side. Distinctive dark brown or black stripes run along each side of the neck, and a short dark stripe may extend from the rear of the eye to the corner of the mouth (Figures 1 and 4). Dorsal scales are keeled, and the anal plate is divided. Hatchlings and juveniles resemble small adults (Powell et al., 2016; Strategic Environmental Research and Development Program, 1998).

Figures 1-4. Southern Hog-nosed Snakes

Range

This species historically occurred from southeastern North Carolina (south of Raleigh) to southcentral Florida (near Lake Okeechobee) and west to southern Mississippi (Beane et al., 2014; Palmer and Braswell, 1995; Tuberville, et al., 2000; Figure 5); however, populations in Mississippi, Alabama, and portions of North Carolina are likely extirpated.

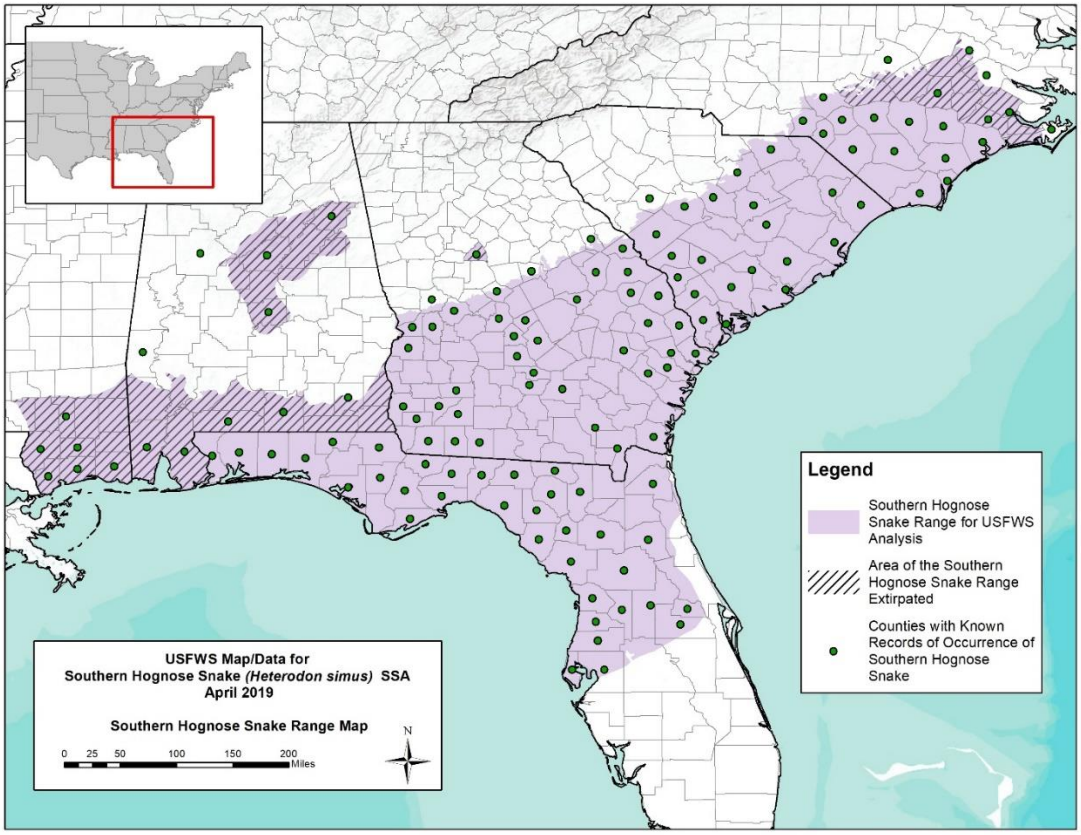

Figure 5. Approximate range of the Southern Hog-nosed Snake (map provided by the USFWS).

Distribution on Military Sites

The Southern Hog-nosed Snake is confirmed present on the following 12 military sites according to the DoW PARC Herpetofauna Database.

- Air Force: Eglin Air Force Base (AFB; Florida), Shaw AFB-Poinsett Electronic Combat Range (South Carolina)

- Army/Army National Guard: Fort Gordon (Georgia); Fort Jackson (South Carolina); Fort Bragg (North Carolina); Fort Benning (Alabama, Georgia); Fort Stewart (Georgia); McCrady Training Center (South Carolina)

- Marine Corps: Marine Corps Base Camp Lejeune (North Carolina)

- Navy: Naval Air Station (NAS) Pensacola (Main Base, Naval Outlying Landing Field (NOLF) Bronson Field, Saufley Field Naval Education and Training Professional Development Center [Florida])

The Southern Hog-nosed Snake is considered unconfirmed, but potentially present on the following military sites. For these sites, specimens have been found in the same county, but not

within the boundaries of the installation. Military sites that are in bold text indicate that they are located within the presumed extirpated range of this species.

- Air Force: Hurlburt Field (Florida); Joint Base Charleston-Weapons Station (South Carolina); MacDill AFB (Florida); Pope Army Airfield (North Carolina); Robins AFB (Georgia); **Seymour-Johnson AFB (North Carolina)**; Tyndall AFB (Florida)

- Army/Army National Guard: McEntire Joint National Guard Base (South Carolina); **Anniston Army Depot (Alabama)**; **Fort Novosel (Alabama)**; Military Ocean Terminal Sunny Point (North Carolina); **Fort McClellan (Alabama)**

- Marine Corps: **Marine Corps Air Station (MCAS) Cherry Point (North Carolina)**; MCAS Beaufort-Townsend Bombing Range (Georgia); Marine Corps Logistics Base Albany (Georgia)

- Navy: NAS Jacksonville-Main Base, Outlaying Landing Field (OLF) Whitehouse, Rodman Bombing Target Range (Florida); NAS Whiting Field- Main Base, NOLF Harold, NOLF Pace, NOLF Santa Rosa, NOLF Spencer, **NOLF Wolf**, OLF Holley (Alabama and Florida); Naval Support Activity Orlando (Florida); Naval Submarine Base Kings Bay (Georgia)

Habitat

The Southern Hog-nosed Snake primarily inhabits xeric sandhills and other sandy upland habitats on the Coastal Plain (Figures 6, 7). These environments typically feature pine (Pinus spp.)-dominated or pine-oak (Quercus spp.) woodlands with a sparse, open understory and wiregrass (*Aristida stricta*) groundcover. This species is most often associated with longleaf pine-wiregrass-turkey oak sandhill communities (Edgren, 1955). Additionally, Southern Hog-nosed Snakes are often observed crossing roads between altered or disturbed habitats, such as fallow fields, mixed forests, clearcuts, and rural yards (Beane et al., 2010; Beane et al., 2014; Jensen, 2008).

Figure 6, 7. Longleaf pine savanna-woodland habitat used by Southern Hog-nosed Snakes (pictures by Shane Welch [left] and Jeffrey Hall [right])

This species spends a good portion of its life in underground shelters such as stump holes, rodent burrows, root channels or gopher tortoise (*Gopherus polyphemus*) burrows (note that tortoises do not occur in the Carolina portion of its range except extreme southern South Carolina). It also digs its own burrows below the surface of the ground or hides under surface litter, vegetation, or sheltering objects (Palmer and Braswell, 1995; Tuberville, et al., 2000).

Behavior

Southern Hog-nosed Snakes are diurnal and are often seen on warm mornings in the spring and fall (Savannah River Ecology Laboratory, 2025). During winter months, these snakes are rarely seen above ground. Mating typically occurs in the spring (mid-May to early June) and fall (late September to early November). Females lay from 6-14 eggs in sandy soil or in logs in the early summer (Savannah River Ecology Laboratory, 2025). Enge (2004) reported a clutch of 19 from a captive breeding. Hatching occurs from late August through October (Gibbons and Dorcas, 2005; Jeffrey C. Beane– personal communication). Only one natural nest has been reported in literature (Beane et al. 2021).

This species feeds largely on toads, especially the eastern spadefoot (*Scaphiopus holbrookii*) although they also have been documented consuming other prey such as lizards and large insects (Beane et al., 1998; Beane et al., 2011). Enlarged rear fangs located at the back of their mouths are used to puncture inflated toads and inject them with a venom (harmless to humans) in the saliva that further immobilizes and subdues their prey (Smiley, 2017).

When confronted by people or a predator, they often put on a threat display which includes neck spreading, hissing, and mock striking. They may even feign death by rolling on their backs, opening their mouths, extruding their tongue, and making their body go limp.

Threats

Southern Hog-nosed Snakes face several significant threats, including the following:

1. Loss of xeric pine forests—such as longleaf pine (*Pinus palustris*) and sandhill habitats—due to development and land conversion.
2. Habitat fragmentation caused by roads, which leads to increased road mortality and reproductive isolation.
3. Potential mortality of eggs and juveniles from predation by red imported fire ants (*Solenopsis invicta*) and many natural predators whose populations have been subsidized through human activities such as feral swine, house cats, and domestic dogs.
4. Fire exclusion practices that allow hardwood trees to grow at unnaturally high densities, reducing the open habitat necessary for nesting and hibernation sites.
5. Unsustainable collection of wild individuals for the pet trade (North Carolina Wildlife Resources Commission, 2023; U.S. Fish and Wildlife Service, 2025).
6. Deliberate killing by people who mistakenly interpret their threat display as an indication that they pose a dangerous threat.

Conservation Status

The International Union for the Conservation of Nature Red List of Threatened Species classifies the Southern Hog-nosed Snake as "Vulnerable" with a decreasing population trend (Hammerson, 2007). It is state-endangered in Mississippi and Alabama (where, as indicated above, it is thought to be extirpated) and state-threatened in North Carolina, South Carolina, and Georgia.

The USFWS was petitioned to list the species in July 2012 and published a substantial 90-day finding in September 2015 indicating listing may be warranted. On August 29, 2025, the USFWS proposed listing the Southern Hog-nosed Snake as a threatened species under the ESA. In addition to listing the species, the USFWS is also proposing a tailored rule under Section 4(d) of the ESA that outlines protections and exceptions to prohibitions of take resulting from certain land management activities (Federal Register-Docket No. FWS-R4-ES-2025-0210).

Recommended Conservation Implementation Strategies and Best Management Practices for Southern Hog-nosed Snakes on Military Sites

In general, implementation of the specific BMPs listed below should not be performed at the expense of existing Southern Hog-nosed Snake populations. Habitat management practices, while serving long-term benefits, should be carefully pre-planned prior to their implementation to minimize potentially adverse impacts to snake activity periods and locations. Make sure to document performance of any of the following BMPs, whether current or future, in your installation's INRMP.

1. **Conduct surveys and document occurrences.** It is recommended that field surveys be conducted at military sites with potential Southern Hog-nosed Snake occurrences (see Distribution on Military Sites section above). For sites with confirmed populations, documenting all known sightings on the installation is essential. Historical records can be accessed through State Natural Heritage databases, complemented by recent citizen science platforms such as iNaturalist and HerpMapper.

   Due to the species' highly cryptic and fossorial nature, targeted surveys are often labor-intensive and may require months/years to yield results. Therefore, opportunistic encounters—such as animals crossing roads or found during routine fieldwork—are also particularly important to document. Field personnel, including contractors, should be encouraged to submit observations along with photographs and coordinates (latitude/longitude or Military Grid Reference System [MGRS]) of any encounters. Expert review of photographs can help verify species identification if needed. For more focused monitoring, the installation of drift fence camera arrays in suitable habitats may be employed to improve detection rates (see Martin et. al., 2017).

2. **Maintain large blocks of properly managed habitat**. Southern Hog-nosed Snakes require large intact tracts of properly managed longleaf pine-turkey oak, sandhills, and forested uplands, thus actions that result in the loss, degradation, or fragmentation of these habitats may impair or disrupt essential behavioral and movement patterns. Activities that may degrade or fragment suitable habitat include exclusion of fire, land

clearing, development, and road widening or improvement. When possible, through the purchase of land and/or conservation easements, connect large tracts of land and establish corridors between isolated patches.

3. **Manage for underground refugia.** Underground refugia such as gopher tortoise burrows, small mammal burrows, and stump holes are essential shelter sites for Southern Hog-nosed Snakes. Management activities such as stump removal, burrow excavation, and subsurface root raking, have the potential to harm this species and degrade habitat. The use of heavy equipment to conduct these activities poses additional risk because of their potential to kill snakes directly, compact the soil, alter the habitat, and encourage the spread of fire ants. Avoid or minimize these actions to the greatest extent practical.

4. **Use prescribed fire to maintain or restore habitat.** Regular prescribed fire, applied on a 1- to 3-year rotation, is highly desirable for the maintenance and improvement of Southern Hog-nosed Snake habitat because it acts to reduce the shrub and midstory woody vegetation and promotes a well-established herbaceous layer (which, in turn, favors the primary prey species utilized by hog-nosed snakes). Current silvicultural standards for gopher tortoise and red-cockaded woodpecker (*Dryobate*s *borealis*) management on installations are consistent with requirements for Southern Hog-nosed Snake habitat maintenance. Use existing natural habitat breaks (topographic features and wetland boundaries), roads, and trails as fire breaks whenever possible. Use of heavy equipment to construct berms or fire lanes should be minimized to avoid negative impacts to ground layer vegetation, soil stability, and Southern Hog-nosed Snake burrow systems.

5. **Use thinning and/or herbicide to improve and maintain habitat, where appropriate.** In cases where excessive tree and shrub canopy cannot be reduced by prescribed fire alone, mechanical thinning or other mechanical and/or herbicidal treatments may be required. Thinning opens the canopy and creates conditions more suitable to the safe application of prescribed fire. Other mechanical techniques that may be appropriate for certain sites include chopping, mulching, and mowing. Herbicides can also be used to reduce shrub and hardwood densities. Individual stems can be selectively killed by basal bark spraying or stem injection (“hack-n-squirt”). If herbicides are used, it is important to select a chemical that has the desired effect on shrubs and hardwoods, but does not significantly harm native, herbaceous ground cover. In addition, herbicides should not be applied to vegetation in depressional areas that temporarily fill with water and thus serve as important breeding sites for the toads upon which Southern Hog-nosed Snakes primarily prey.

6. **Manage predators and invasive species.** Controlling both predator populations and invasive species is important for the Southern Hog-nosed Snake. Several non-native species pose direct or indirect threats to this fossorial reptile, particularly during vulnerable life stages such as eggs and juveniles. Red imported fire ants (*Solenopsis invicta*) are a significant threat, capable of preying on snake eggs and hatchlings. While some non-chemical control methods are available (Tschenkel and King 2007), they are generally effective only at small scales. It is recommended that you consult your installation pest management personnel for current management techniques for fire ants.

Soil disturbance, which often facilitates the colonization of fire ants, can be reduced by avoiding the creation of new fire lines, especially when they are not necessary.

Cogongrass (*Imperata cylindrica*) is an aggressive, non-native grass that forms dense, monotypic stands, displacing native herbaceous vegetation critical to the Southern Hog-nosed Snake's prey and movement. It also alters fire behavior, increasing fire intensity and frequency in ways that may be detrimental to native fauna. Early detection and rapid response to this species are essential. Control methods may include targeted herbicide application, mechanical removal, and prescribed fire, used in combination and in accordance with invasive species management plans.

Other invasive or feral species, such as feral hogs and domestic cats, can also negatively impact species populations through habitat destruction and direct predation. These species should be reduced by trapping, poisoning, shooting/hunting, and other procedures in accordance with guidance and protocols provided by DoW environmental personnel and local wildlife agencies.

7. **Develop signage, educational, and outreach tools**. Areas known or suspected to support Southern Hog-nosed Snakes should be clearly marked with signage along roads and other human travel corridors to inform personnel of the species' presence and vulnerability to military operations and other human activities. Signs should include a contact number for reporting illegal or unauthorized activities as well as observations of live or dead snakes that are thought to be this species; documentation of these observations with a camera (including those on a smartphone) is highly recommended whenever possible. Many soldiers and field personnel may be unaware of the Southern Hog-nosed Snake's presence, biology, conservation status, and susceptibility to certain training and land management practices. While these guidelines do not restrict training activities, all personnel—including contractors—engaged in field operations should receive training or informational materials on minimizing impacts whenever possible, without compromising mission objectives.

   Outreach and education efforts should cover snake identification, the importance of conserving this species to the DoW mission, and how specific activities—such as heavy wheeled or tracked vehicle use and mechanical digging—can directly harm the snakes and cause significant habitat damage.

8. **Prohibit killing and collecting.** The killing and collection of Southern Hog-nosed Snakes have obvious negative impacts to populations and are illegal activities in many of the states where this species occurs. Treat reports seriously and remain observant for signs of intentional killing and collecting. Wildlife enforcement officials should be contacted immediately, and evidence provided whenever possible, of individuals observed killing, attempting to kill or otherwise harm, or collecting this species.

Benefits of Southern Hog-nosed Snake Best Management Practices to Military Training Operations

1. Identification of occupied habitat enables military planners to account for these sensitive areas when developing and/or scheduling training and maneuvering activities.

2. BMPs support the conservation goals outlined in military installation INRMPs and those of state and federal stakeholders.

3. Implementation of Southern Hog-nosed Snake BMPs benefits a wide group of at-risk species, such as gopher tortoises and red-cockaded woodpeckers, and supports other natural resource management projects and conservation goals.

DoW PARC Point of Contact

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Military Service Points of Contact

Contact your Military Service headquarters natural resources personnel with questions regarding Southern Hog-nosed Snake and conservation actions:

Navy: Marc Hall (marc.a.hall8.civ@us.navy.mil; 202-685-9331)
Marine Corps: Jacque Rice (jacqueline.rice@usmc.mil; 571-256-2796)
Army: Jason Applegate (jason.r.applegate.civ@army.mil)
Air Force: Paul Jurena (paul.jurena.1@us.af.mil; 210-925-4448)

High Priority Research Questions

Confirmation of Southern Hog-nosed Snake at Unconfirmed Military Sites

There are several military sites where this species has potential occurrence and has not been confirmed present (see Distribution on Military Site above). It is recommended that surveys be conducted to confirm the presence or likely absence of the species on those military lands.

The use of drift fence arrays (with buckets and funnel traps) and coverboards have been used to successfully capture this species. However, these methodologies have generally not been very effective, even in areas where this species is considered common. An alternative survey method, which is less labor intensive and causes less mortality of nontarget species, is to use drift fence arrays coupled with camera traps (see Martin et. al., 2017).

By far the most effective survey method for Southern Hog-nosed Snakes is driving, biking, or even walking paved or sandy roads in the fall (late September to October especially, but timing

will vary regionally). Road surveys between approximately 10 am and 4 pm on sunny days with temperatures in 70s and low humidity in early October are usually the absolute best (Jeffrey C. Beane– personal communication).

Population Size and Trends

The stability of the Southern Hog-nosed Snake population on a military installation is influenced by population size (number of snakes present), demography (sex and age ratios), and population trajectory (rate of increase or decrease). Surveys that focus on population size and trends are needed on DoW sites.

Additional Sources of Information on Southern Hog-nosed Snakes

- NatureServe Explorer
- International Union for Conservation of Nature
- Animal Diversity Web
- Savannah River Ecology Laboratory – University of Georgia

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Literature Cited

Beane, J.C., T.J. Thorp, and D.A. Jackan. 1998. *Heterodon simus*: diet. Herpetological Review 29:44-45.

Beane, J.C., A.L. Braswell, J.C. Mitchell, W.M. Palmer, and J.R. Harrison III. 2010. *Amphibians and Reptiles of the Carolinas and Virginia, 2nd Ed*. Chapel Hill, North Carolina: University of North Carolina Press.

Beane, J.C., K.R. Messenger, and D.L. Stephan. 2011. *Heterodon simus*: diet. Herpetological Review 42:292.

Beane, J.C., S.P. Graham, T.J. Thorp, and L.T. Pusser. 2014. Natural history of the southern hognose snake (*Heterodon simus*) in North Carolina, USA. Copeia 2014:168-175.

Beane, J.C., M.D. Martin, D.C. Smith and S.J. Horton. *Heterodon Simus* (Southern Hog-nosed Snake) Reproduction and Nesting. 2021. Herpetological Review 52:424-425.

Edgren, R. 1955. The natural history of the hog-nosed snakes, genus *Heterodon*: A review. Herpetologica, 11(2):105-117.

Enge, 2004 Bull. Maryland Herp. Soc. 40(2):76.)

Gibbons, J., M. Dorcas. 2005. *Snakes of the Southeast*. Athens, Georgia: University of Georgia Press.

Hammerson, G.A. 2007. "*Heterodon simus*" (On-line). The IUCN Red List of Threatened Species 2007. https://www.iucnredlist.org/species/63821/12718888. Accessed 9 September 2025.

Jensen, J. 2008. *Amphibians and Reptiles of Georgia*. Athens, Georgia: University of Georgia Press.

Martin, S. A., R. M. Rautsaw, F. Robb, M. R. Bolt, C. L. Parkinson, and R. A. Seigel. 2017. Set AHDriFT: applying game cameras to drift fences for surveying herpetofauna and small mammals. Wildlife Society Bulletin 41(4):804-809.

North Carolina Wildlife Resources Commission. July 13, 2023. Southern Hognose Snake Conservation Plan for North Carolina. North Carolina Wildlife Resources Commission.

Palmer, W.M., and A.L. Braswell. 1995. *Reptiles of North Carolina*. The University of North Carolina Press, Chapel Hill, North Carolina.

Powell, R., R. Conant, and J.T. Collins. 2016. *Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America. Fourth edition*. Houghton Mifflin Harcourt, Boston.

Savannah River Ecology Laboratory, University of Georgia. “Southern Hognose Snake (*Heterodon simus*).” https://srelherp.uga.edu/snakes/southern-hognose-snake/. Accessed 16 September 2025.

Smiley, G. 2017. "*Heterodon simus*" (On-line), Animal Diversity Web. https://animaldiversity.org/accounts/Heterodon_simus/. Accessed 16 September 2025

Strategic Environmental Research and Development Program. 1998. Species profile: Southern hognose snake (*Heterodon sinus*) on military installations in southeastern United States. 98(4). Chapel Hill, North Carolina: The Nature Conservancy.

Tschenkel, W.R., and J.R. King. 2007. Targeted removal of ant colonies in ecological experiments, using hot water. Journal of Insect Science 7:1-12.

Tuberville, T.D., J.R. Bodie, J.B. Jensen, L. LaClaire, and J.W. Gibbons. 2000. Apparent decline in the southern hog-nosed snake, *Heterodon simus*. Journal of the Elisha Mitchell Scientific Society 116:19-40.

US Fish and Wildlife Service Environmental Conservation Online System (On-line). “Southern hognose snake (*Heterodon simus*).” US Fish and Wildlife Service, August 2025, https://ecos.fws.gov/ecp/species/3248. Accessed 16 September 2025.